

An Investigation of Ostracode Preservation

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MANY authors have considered the problem related to fossil preservation as it affects interpretation in paleoecology. If a fossil assemblage is used to reconstruct an ecological situation, knowledge of the composition of the original population is necessary. Ager (1963) emphasizes that preservation is selective for various groups and within one group.

Ostracodes are abundant in many geologic formations and as fossils they have been used as indicators of habitat (Benson and Coleman, 1961). A factor that must be considered in the paleoecology of ostracodes (and other groups) is precisely what kinds of specimens are preserved in relation to the proportions in the once living assemblage.

To initiate this study, four ostracode species were selected from Recent bottom samples collected in Florida Bay, near Vaca Key. *Bairdia victrix* Brady, *Cushmanidea elongata* Brady, *Loxocorniculum postdorsalatum* (Puri), and *Mutilus confragosa* (Edwards) were chosen because they are quite different in size, valve thickness, and ornamentation. *Bairdia victrix* Brady is a large smooth species in contrast to *Cushmanidea elongata* (Brady) which is small and thin-shelled. Moderate ornamentation is found on *Loxocorniculum postdorsalatum* (Puri), while *Mutilus confragosa* (Edwards) is heavily ornamented.

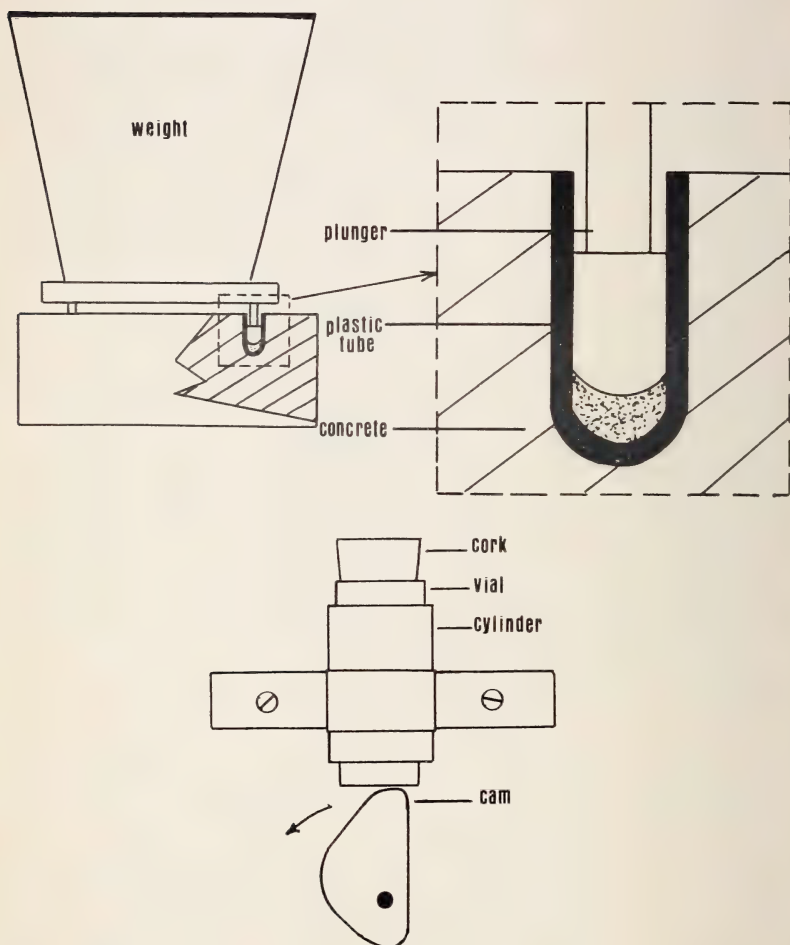
PROCEDURES AND RESULTS

Using the species just mentioned, 40 adult valves of each were selected. Each valve was examined under magnification to insure that there were no incipient fractures.

The base of the test device used consisted of a wooden box filled with concrete into which four test tube holes were formed. While the concrete was wet the plastic test tubes were coated with silicon lubricant and thrust into the concrete, and left until it had hardened. The concrete thus supported the plastic test tubes, but the tubes could be removed at will. See Figure 1.

A small portion of the sediment from the sample was placed in a plastic test tube which was to be encased in concrete (Fig. 1). Ostracodes of each test species were placed on the wet matrix and

covered with more sediment from the sample. The entire column of sediment and ostracodes was then wetted, either with fresh or sea water. The water was allowed to soak into the sample and at no time during testing was the material dried out.



Figs. 1-2. Fig. 1 (upper). Slow crushing apparatus. Fig. 2 (lower). Sediment agitator.

A wooden dowel was tipped with the rubber portion of a medicine dropper. This plunger assembly was then inserted into the tube with ostracodes and matrix. A silicon lubricant was spread on

the rubber plunger head to prevent water evaporation. During the insertion, however, excess water was forced out past the seal, but then the remaining water could not evaporate.

The tops of the wooden dowels (plungers) were covered with a board so that the load would be evenly distributed. A plastic container was placed on the board as shown in Fig. 1. Slowly, over a period of a week, water was added to the container until the entire load equalled 20 pounds. Using the cross-sectional area of the plungers it was found that the pressure on the top of the matrix was about 15 pounds per square inch.

Two trials were made, each with two tubes wetted with fresh water, and two wetted with sea water. Each tube contained five valves of each test species; therefore, each trial tested 20 valves of each species.

After the load was removed, each test tube was carefully washed and all matrix material was recovered in a 200 mesh screen. Under magnification all particles were examined and ostracode valves and fragments were recovered.

The results of the slow crush tests show that there is a difference in resistance of ostracode valves to loading. Each of the four species displays a different percentage of recovery.

Based on 40 valves of each species, it was found that the greatest recovery was for *Bairdia victrix*, with 26 valves and two fragments. *Mutilus confragosa* was second in abundance after the crush tests. It yielded 18 complete valves and one recognizable fragment. *Loxocorniculum postdorsalatum* showed more effect of the loading giving only six valves and two fragments. Only one valve of the original 40 was recovered of *Cushmanidea elongata*.

Another mechanical test was performed using the four test species. Again, 40 valves of each were selected and these were also examined to insure that they were not cracked or broken.

The 40 ostracode valves were placed in a small glass vial with a thin layer of wetted sediment from the sample. The vial was closed and placed in a metal cylinder so arranged that the vial rested on an eccentric wheel. The eccentric was driven by a small electric motor which rotated at 100 revolutions per minute (Fig. 2).

The maximum lift of the eccentric was 0.8 inches. Eccentric configuration is shown in Fig. 2. Several shapes were tried until one was selected that provided moderate agitation and smooth operation.

The vial was allowed to remain in the cylinder with the motor operating for a week. When examined the ostracodes showed only a polish; no further damage could be seen.

After two weeks of total operation the vial was again removed and the contents examined. The smooth *Bairdia victrix* displayed only a high polish. *Cushmanidea elongata* displayed a high polish with some fractures visible. Ornamentation was slightly worn on both *Loxocorniculum postdorsalatum* and *Mutilus confragosa*.

Finally, after three weeks of agitation, the process was stopped and the ostracodes were removed from the sediment. It should be noted that all examinations were carried out using a specially constructed screen made of standard 200 mesh. Each time, the entire contents of the vial were examined under a microscope to insure complete recovery of all fragments.

At the end of the three week test the most abundant ostracode found was *Bairdia victrix*. Of the 40 originally put into the vial, 36 of this species were found complete and one had been broken. *Mutilus confragosa* was second in numbers recovered, with 24 whole valves and two fragments. *Loxocorniculum postdorsalatum* remained as 20 valves and five fragments. The least number of valves seen were those of *Cushmanidea elongata*; 14 valves and two fragments were recovered.

In both tests the species showed the same order of resistance. The tests were not intended to reproduce geologic time in any way, but simply to demonstrate the ability of the various ostracode valves to withstand crushing and abrasion.

An attempt was made to test, directly, the crush strength of single valves by applying weight to a single valve.

A rod was attached to a light plastic container. This assembly was free to move through a rigidly mounted vertical cylinder. Two such assemblies were fabricated, one weighed 11.25 grams and the other 30.04 grams, dry weight. Water was slowly added to the cylinder thereby increasing the weight (Fig. 3).

The crushing tip of the apparatus was gently placed on the outside surface of an ostracode valve. Water was allowed to flow from a burette into the plastic contained. In this way it was hoped that the weight needed to crush a valve could be measured.

All valves were wetted with tap water before crushing. This is important to note because the strength of the valves is different if dry. Once wetted the valves are less strong and this was selected

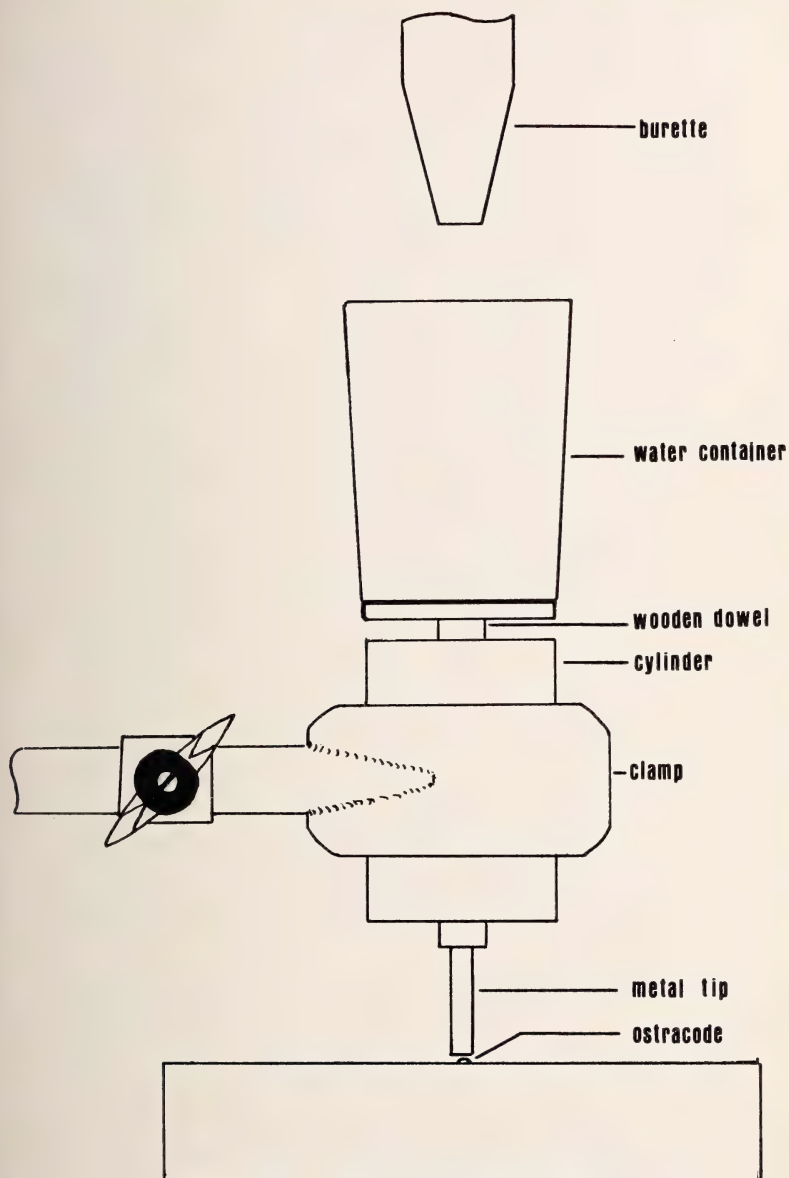


Fig. 3. Rapid crushing apparatus.

as the standard. Certainly in bottom sediment the valves are wet, and it is a likely condition with ground water also.

It was hoped that weights determined for crushing could be offered only as a means of comparing the four species. The values were not to be construed as absolute crushing strengths.

In practice it was found that *Cushmanidea elongata* and *Loxocorniculum postdorsalatatum* were crushed with the lighter of the two units even if no water was added. The lighter unit weighed 11.25 grams as mentioned above.

Bairdia victrix and *Mutilus confragosa* were not crushed by the lighter unit filled with water; the weight was 26.88 grams.

When the heavier unit was applied all *Mutilus confragosa* were crushed without the addition of water. *Bairdia victrix* all required some water to be added to cause crushing.

It is obvious that new crushing units will have to be constructed which span the entire range of ostracode valves. Many more trials will be required before the crushers can be made of the proper weights. It will be interesting to see if fast crushing can be correlated to the abrasion and slow crushing tests.

The abrasion and slow crush tests do indicate that ostracode valves probably are not preserved in proportion to the species in the living assemblage. If this premise is indeed probable, it is in order to use a sample as an example of what could result. Ecological data are derived from Benson and Coleman (1963), Puri and Hulings (1957), Hulings and Puri (1964), and Van Morkhoven (1963).

In the sample used in this study, *Cushmanidea elongata* equaled 41.8 per cent of the recovered ostracodes. If this species is not preserved in direct proportion to the living population, then the fossil assemblage would reflect neither the true population nor the ecology. This error would exist even if there were no disturbance by factors such as currents.

In the sample, *Bairdia victrix* is 6.7 per cent of the total population. If this ostracode is preserved in greater proportions than *Cushmanidea elongata* an erroneous paleoecologic situation would be reconstructed. Instead of a very shallow water, low salinity (less than 30 parts per thousand) environment, the investigation might conclude that the water was greater than 65 feet deep with a salinity of 35 to 40 parts per thousand.

It is believed that much work should be done to approximate the probable ratios of preservation of ostracodes and other micro-

fossils. In this manner the paleoecology can be more validly used. If no relationship can be established between living and fossil population, the usefulness of the preserved populations in paleoecology is doubtful.

SUMMARY

Even if the ecology of modern groups were perfectly known, the paleoecologists would be confronted with the question of differential preservation. This is not a new idea, but a means is needed to clearly demonstrate what groups are preserved or destroyed.

Testing by mechanical means indicates that various ostracode taxa are probably not preserved in proportion to the representation in the living fauna. Extension of such testing will be useful to predict what proportions are preserved, and in reconstructing the fossil populations of ostracodes and other groups.

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Dr. Richard A. Edwards and Dr. Caspar Rappenecker of the Geology Department of the University of Florida made the completion of this study possible.

LITERATURE CITED

- AGER, D. V. 1963. *Principles of Paleocology*. New York, McGraw-Hill Book Co., Inc., 371 pp., 8 pls., 147 figs.
- BENSON, R. H. AND G. L. COLEMAN. 1963. Recent Marine ostracodes from the eastern Gulf of Mexico. *Kansas Univ., Paleont. Contr.* 31, *Arthropoda*, art. 2, 52 pp., 8 pls., 33 figs.
- HULINGS, N. C., AND H. S. PURI. 1964. The ecology of shallow water ostracods of the West Coast of Florida. *Pubbl. staz. zool., Suppl.*, Vol. 33, pp. 308-344, 17 figs.
- PURI, H. S., AND N. C. HULINGS. 1957. Recent ostracode facies from Panama City to Florida Bay area. *Trans. Gulf Coast Assoc. Geol. Soc.*, vol. 7, pp. 167-190, 11 figs.
- VAN MORKHOVEN, F. P. C. M. 1963, *Post-Paleozoic Ostracoda*. New York, American Elsevier Publ. Co., vol. 2, 478 pp., 763 figs.

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